Orbit & Sinus: What are you looking for?

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Objectives

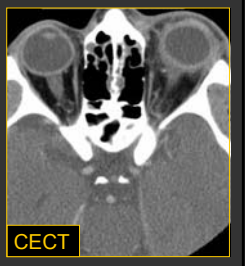
- Recognize imaging findings in orbits & paranasal sinuses that will change patient management.
- Be able to develop "checklist" for imaging findings within orbits & paranasal sinuses that decreases likelihood of overlooking pertinent associated findings.

Orbits & Sinuses

- Infection
- Trauma
- Neoplasm

Orbit: Infectious

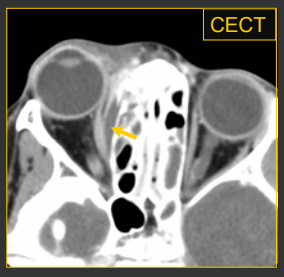
- **Pre - or post-septal**
- **Most often secondary to underlying paranasal sinusitis**
  - **Maxillary & ethmoid most common**
- **Other etiologies:**
  - **Trauma**
  - **Bacteremia**
  - **Skin infections**
  - **Dental infections**



Panophthalmitis

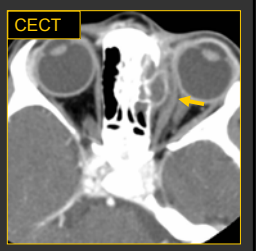
Orbit: Infectious

- Subperiosteal abscess
  - **Spread from sinus to orbit**
    - **Transmission via valveless venous plexus**
  - **Direct extension:**
    - **Lamina papyracea dehiscence**
  - **Visual disturbance:15-30%**
    - **Optic neuritis**
    - **Ischemia:**
      - **↑ intraorbital pressure**
      - **Retinal ischemia: Central artery occlusion or thrombophlebitis**



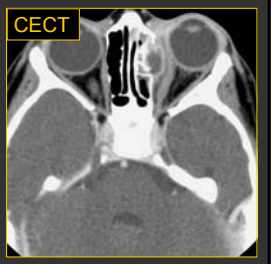
Subperiosteal Abscess: Orbit

- **CT:**
  - **Medial orbital wall with adjacent sinusitis**
    - **Lentiform, rim enhancing**
    - **Medial rectus displacement**
  - **Lamina papyracea dehiscence**
- **MR**
  - **Post contrast: Rim enhancement; intra- & periorbital enhancement**
    - **Fat suppression optimal**
- **Requires immediate attention!**
  - **May result in blindness**



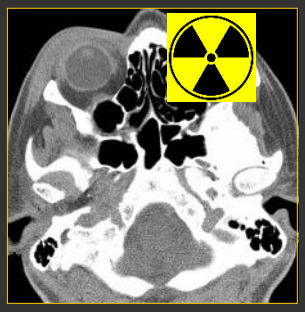
Orbital Infection: Checklist

- ✓Abscess?
- ✓Evidence of cavernous sinus thrombosis?
  - Rare
- ✓Evaluate brain – evidence of:
  - Meningitis? – Lumbar puncture
  - Subdural empyema?
  - Abscess?
  - Cerebritis?



Preseptal Cellulitis

- Anterior to orbital septum
- May be difficult to distinguish clinically from subperiosteal abscess
- Orbital involvement suspected:
  - Proptosis
  - Extraocular motility defects
  - Decreased vision

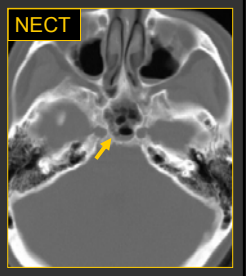


Preseptal Cellulitis

- In pediatric patients & in skilled hands → US useful for rapid evaluation of preseptal vs. postseptal involvement
- US limited in ability to assess:
  - Intracranial extension
  - Orbital apex
  - Paranasal sinuses

Sinus Infectious

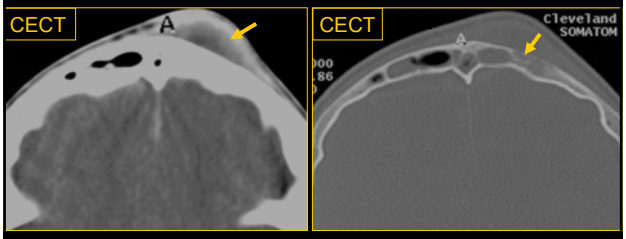
- Acute sinonasal inflammatory disease
  - Typically not imaged → Clinical diagnosis
  - Resolves with conservative measures
  - Imaging Features
    - Air-fluid level
    - Bubbly secretions
- Complicated sinonasal inflammatory disease → Image
  - Orbital &/or CNS complications



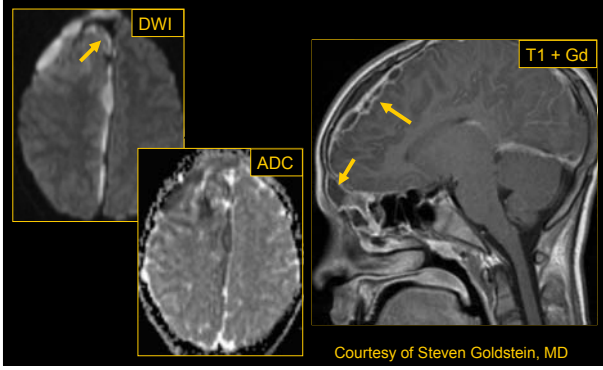
Acute sinusitis: Complications

- Local extension
  - Orbital: Sub-periosteal abscess
  - Intra-cranial : Empyema, meningitis, cerebritis, abscess
  - Superficial: Osteomyelitis, subgaleal abscess
- Venous occlusion: Cavernous sinus

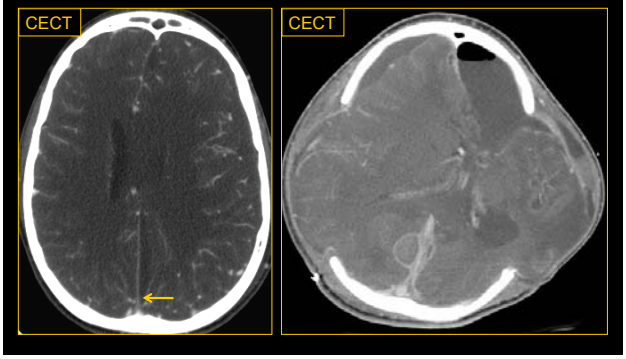
Pott's Puffy Tumor



Subdural Empyema

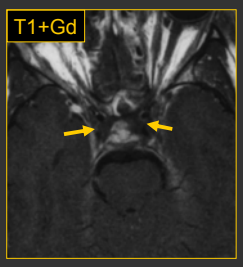


Subdural Empyema



Sinusitis: Checklist

- ✓Evidence of local extension
  - ✓Orbital
  - ✓Intra-cranial
  - ✓Superficial
- ✓Evidence of venous occlusion



Fungal Sinusitis

- Subtypes:
  - Acute invasive
  - Chronic invasive
  - Chronic granulomatous invasive
  - Allergic fungal
  - Fungal mycetoma ("fungus ball")

Invasive

Non-invasive

Invasive = Presence of fungal hyphae within mucosa, submucosa, bone, or blood vessels of paranasal sinuses

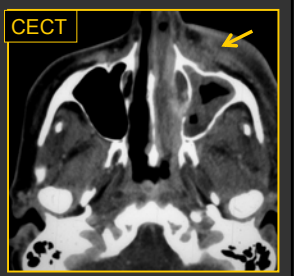
Fungal Sinusitis: Acute Invasive

- Rapidly progressive
  - Mortality: 50-80%
- Diabetic or other immunocompromised
- Maxillary & ethmoid most common
- Adjacent bone erosion & soft tissue infiltration

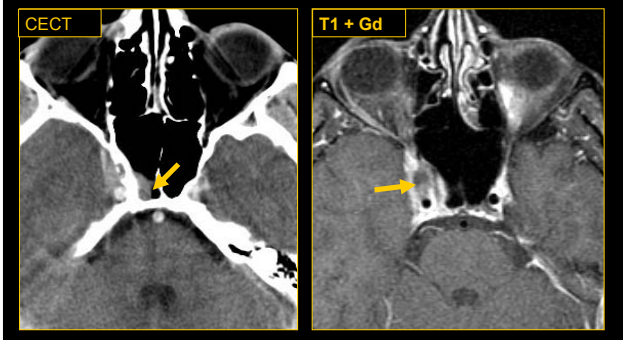
Mucor

Fungal Sinusitis: Acute Invasive

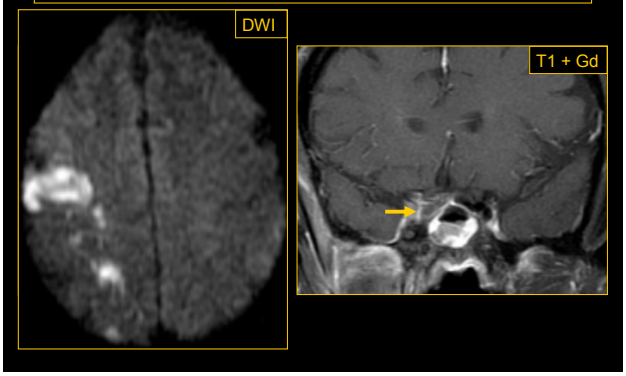
- **CT/MR**
  - **Obliteration of periantral fat: May be subtle!**
  - **Late:**
    - **Intracranial/orbital spread**
      - **Leptomeningeal enhancement may be subtle in early stage**
    - **Bone destruction**



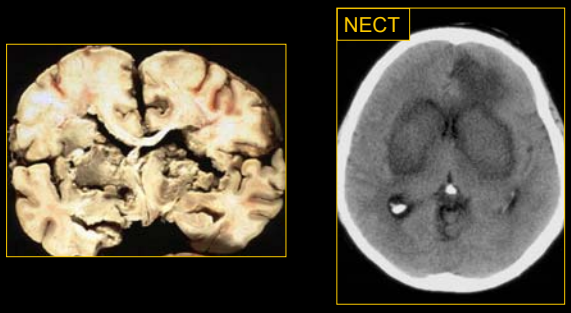
Beware Isolated Sphenoid Sinus Disease in Immunocompromised!



Mucormycosis

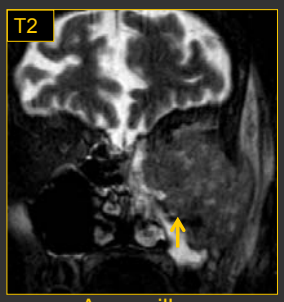


Mucor



Invasive Fungal Sinusitis

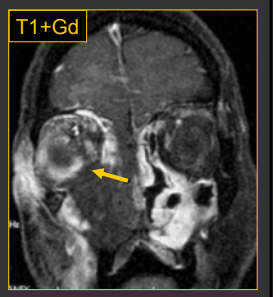
- Mycetoma low T2
  - ? paramagnetic materials produced by fungi
  - ? semisolid, cheesy nature of mycetoma



Aspergillus

Invasive Fungal Sinusitis Checklist

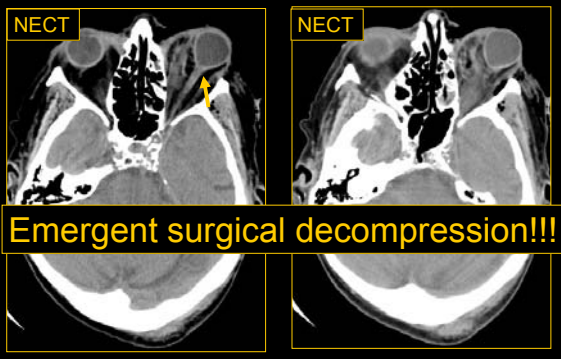
- ✓Evaluate periantral fat
- ✓Evaluate orbit & intracranially for involvement
- ✓Evaluate cavernous sinus & internal carotid



Trauma: Orbit

- **Eye trauma: 3% of ER visits**
- **Concomitant injury to brain, spinal cord, or facial bones common**
- **Injuries:**
  - **Intraorbital foreign body**
  - **Optic nerve**
  - **Open globe**
- **CT imaging study of choice**

Globe Tenting

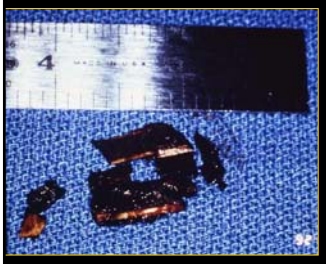


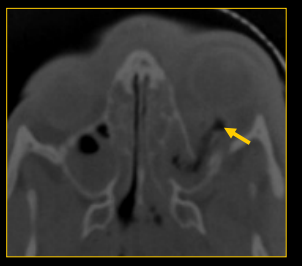
Emergent surgical decompression!!!

Orbital Foreign Bodies

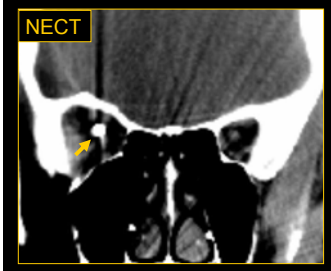
- CT scan: Test of choice
- Most common cause: Hammering
- May be observed:
  - Smooth edges
  - Located in posterior orbit
- Removed:
  - Composed of vegetable matter
  - Iron containing can cause siderosis
  - Lead containing – may cause lead poisoning
  - Copper - sterile endophthalmitis
  - Easily accessible in anterior orbit

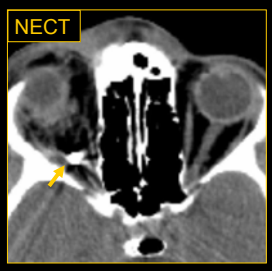
Foreign Body: Wood



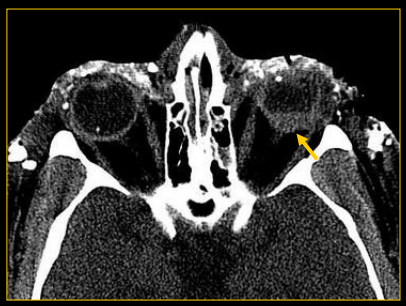


Orbital Foreign Body: "Double Perforation"





Trauma: Hemorrhagic choroidal detachment

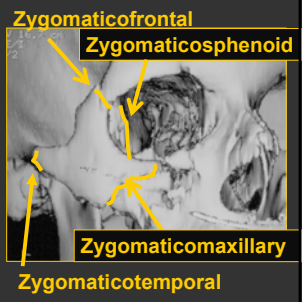


Orbital Trauma Checklist

- ✓Presence of foreign body
- ✓Hemorrhage
- ✓Status of optic nerve
  - ✓Orbital apex
- ✓Intracranial injury

Sinus & Orbit: Zygomaticomaxillary Complex (ZMC) fracture

- Disjunction of zygoma from adjacent osseous connections
- "Tripod" abandoned
  - Quadripod



ZMC Fracture Complications/Checklist

- ✓ Infraorbital foramen – paresthesias
- ✓ Zygomatic arch impale coronoid process → trismus
- ✓ Fractured uncinate – posttraumatic sinus disease
- ✓ Lateral rectus impaled by lateral wall of orbit
- ✓ Ruptured Globe

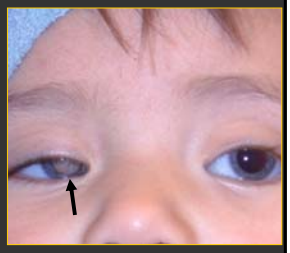
Neoplastic

- Orbit
  - **Retinoblastoma**
  - **Melanoma**
  - **Lymphoma**
  - **Metastasis**
  - **Rhabdomyosarcoma**
- Sinus
  - **SCC**
  - **Adenocarcinoma**
  - **Esthesioneuroblastoma**
  - **Inverting papilloma**
  - **SNUC**
  - **Lymphoma**
  - **Melanoma**

Melanoma

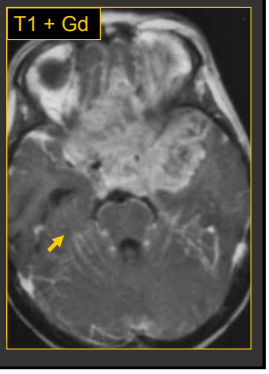
Retinoblastoma

- Primary retinal malignant neoplasm
- 90-95% before age 5
  - Most common intraocular tumor of childhood
  - Hereditary form earlier
- Location:
  - Unilateral: 70-75%; 30% multifocal
  - Bilateral: 25-30%
  - Trilateral (midline neuroblastic tumor +bilateral ocular): Rare
  - Quadrilateral (suprasellar + bilateral ocular + pineal): Rare



Retinoblastoma

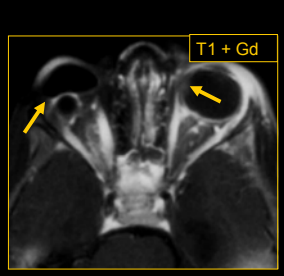
- Ophthalmoscopic diagnosis primarily
  - Small gray-white intraretinal lesions, calcification, seeding
  - Ultrasonography: 80% accurate
- Staging:
  - Stage 1: Confined to globe
  - Stage 2: Extraocular extension to orbit or optic nerve
  - Stage 3: Extra-orbital extension
- 92% 5-year survival for intra-ocular lesions

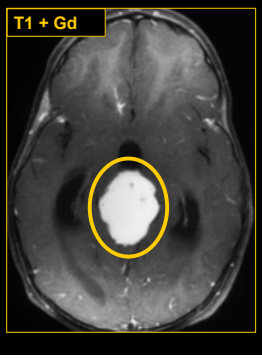


Retinoblastoma: Imaging

- CT: Calcified intraocular mass 90-95%
  - Utilize thin section (1.5m)
- MRI
  - ↑T1, ↓T2
  - Optic nerve & transscleral extension?
  - Anterior segment involvement?

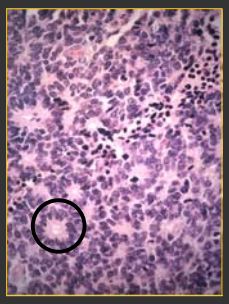
Trilateral Retinoblastoma





Retinoblastoma: Pathology

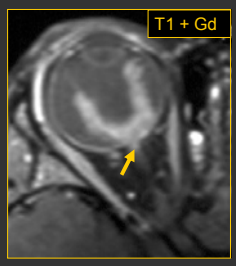
- Neuroectodermal origin: primitive embryonal retinal cells (retinoblasts)
- Rosettes: Flexner-Wintersteiner
- Highly malignant: Necrosis, mitotic figures
- Calcification



Retinoblastoma

- 90% cure rate for non-invasive
- Biopsy carries risk of seeding – radiologic diagnosis critical
- Regular screening for children with family history
- Surveillance through age 7 years assess for development of metachronous disease

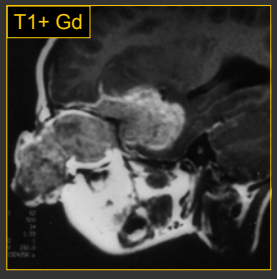
Retinoblastoma



- Optic nerve/intraorbital extension: 10-15%
  - Poor prognostic factor

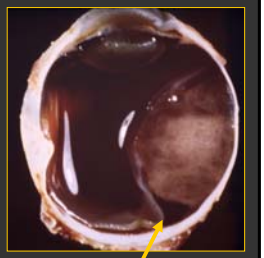
Retinoblastoma: Checklist

- ✓Intracranial trilateral or quadrilateral disease?
- ✓Involvement of anterior segment?
- ✓Optic nerve involvement or transscleral extension?



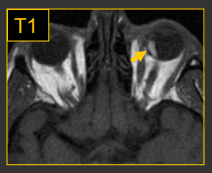
Melanoma

- Melanoma: Most common primary intraocular tumor in adults
- Arises from melanocytes within the choroid
- Whites (15:1)
  - Incidence increases with age
- Metastasize to liver & lung

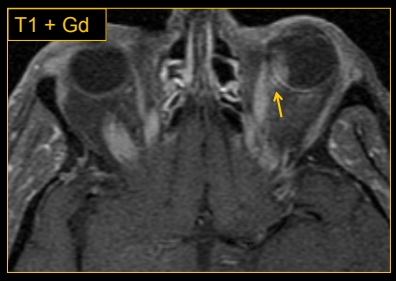


Melanoma: Imaging

- CT:
  - High density
  - Enhance
- MRI:
  - T1 hyperintense
  - T2 hypointense
  - Amelanotic: T1 hypointense, T2 hyperintense
  - Lesions elevated > 3 mm usually seen on MR
    - < 3mm better evaluated by US



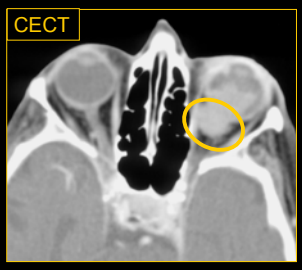
Extraocular Invasion



Poorer prognosis & different therapeutic implications

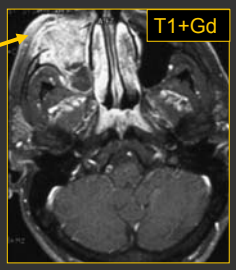
Melanoma Checklist

✓Extraoccular invasion



Sinonasal Neoplasms

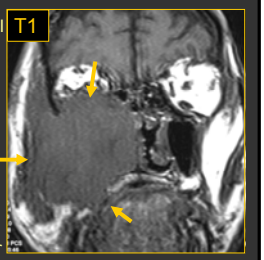
- SCCa
- Esthesioneuroblastoma
- Adenocarinoma
- Sinonasal undifferentiated carcinoma (SNUC)
- Lymphoma
- Melanoma



SCCa

Squamous Cell Carcinoma

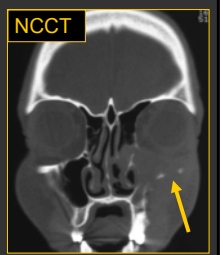
- Malignant epithelial tumor
  - Most common malignancy of sinonasal area
- Maxillary antrum most common (85%)
- Pre-surgical evaluation of extent:
  - Anterior: SQ tissue of cheek
  - Superior: Orbit
  - Inferior: Hard palate, maxillary alveolar ridge
  - Posterior: Retroantral fat & PPF
  - Perineural spread



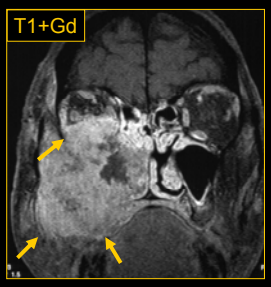
Lymph node: 15% at presentation – retropharyngeal & jugulodigastric

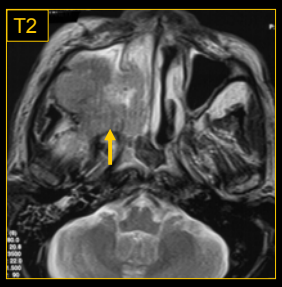
SCC: Imaging

- CT:
  - Bone destruction
  - Heterogeneous enhancement
- MRI
  - T1: Intermediate signal
  - T2: Lower signal than most sinonasal malignancies
  - Post contrast: Heterogeneously enhances
    - Enhancement < adenocarcinoma, esthesioneuroblastoma, melanoma
    - Fat sat: Perineural spread



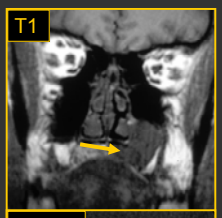
SCC

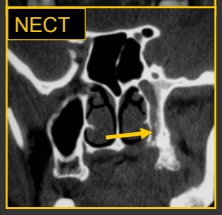




Perineural Spread

- Perineural spread
  - Widened foramen or canal
  - Enlarged enhancing nerve
  - Obliteration of fat at skull base foramen

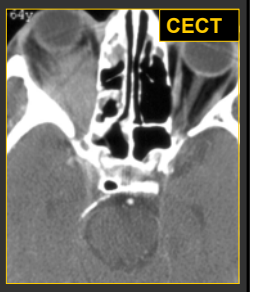




Adenocarcinoma

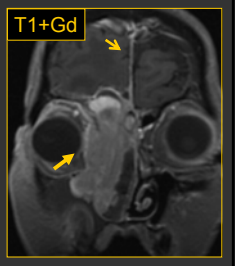
Neoplasm: Checklist

- ✓Evaluate for extension: Orbit, palate
- ✓Evaluate pterygopalatine fossa and for evidence of perineural spread
- ✓Malignant adenopathy



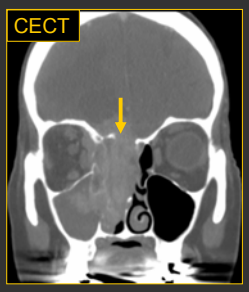
Esthesioneuroblastoma

- Neuroendocrine malignancy of neural crest origin
- Arises from olfactory epithelium
- Bimodal age distribution: 2nd & 6th decades
- Malignant cervical lymph nodes at presentation: 20%
- Long term follow up: Tend to recur late

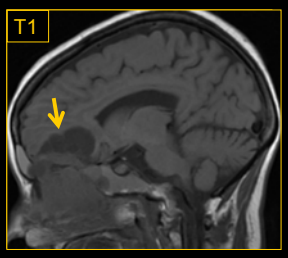


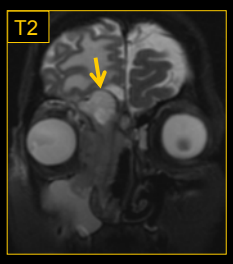
Esthesioneuroblastoma

- CT
  - Bone remodeling mixed with destruction
  - Homogeneously enhances – may have areas of necrosis
- MRI
  - T1: Hypo- to isointense
  - T2: Iso- to hyperintense



Esthesioneuroblastoma





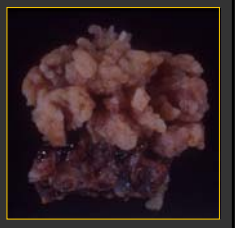
Intracranial peripheral tumor cysts suggestive of diagnosis

Esthesioneuroblastoma: Checklist

- ✓Degree of spread
- ✓Lymph node or distant metastasis

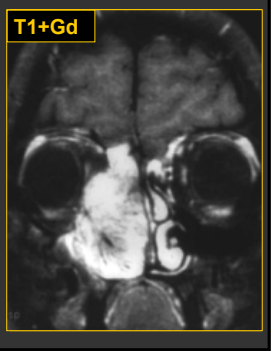
Inverted Papilloma

- Epithelial tumor of nasal mucosa
- Most commonly originates in lateral wall of nose
- Spread into adjacent sinuses & possibly orbit & CNS
- Morphology: "Cerebriform"
- 5-15% Associated with SCCa



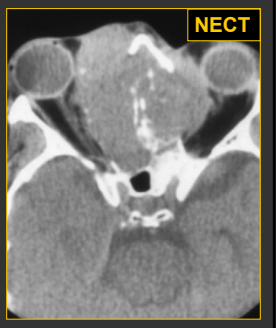
Inverted Papilloma

- High recurrence rate & associated SCCa → Imaging follow up
- Identifying adjacent areas of invasion may alter surgical approach
- Locally invasive disease difficult to evaluate on nasal endoscopy

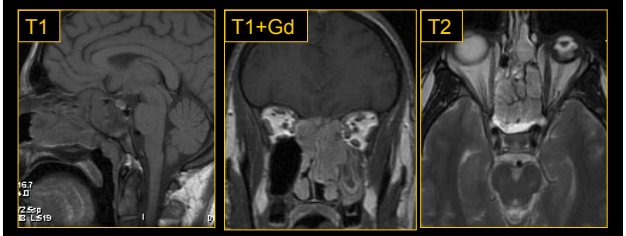


Inverted Papilloma

- CT:
  - Large remodels nasal cavity & invades/obstructs adjacent sinuses
    - Osseous destruction – Consider associated SCCa



Inverted Papilloma



- MR:
  - T2: Curvilinear striations → cerebriform
  - Enhance: May have convoluted appearance
  - If appears invasive consider SCCa

Inverted Papilloma: Checklist

- ✓Adjacent areas of invasion on imaging
- ✓Association with SCCa

Conclusion

- Developing a “checklist” for imaging findings within orbits & paranasal sinuses decreases likelihood of overlooking pertinent associated findings.

Courtesy Steven Goldstein, MD